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By-Miller, James O.

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Reviewing of long term and short term intervention research undertaken by Skeels and Dye (1939), Dawe (1942), Brazziel and Terrell (1962), Carter (1966), Sigel, Roeper, and Hooper (1966), Weikart (1967), Klaus and Gray (1967), Karnes and others (1966), Bereiter and Engelmann (1966), Blatt and Garfunkel (1965), Nimnicht (1966), and Smilansky (1964 and 1966) suggests that future research should be approached cautiously but with optimism. Short term intervention research has made gains when directed to specific behaviors, but its effects on complex behaviors have not been established. Massive environmental change produces great improvement in abilities associated with adult social competence and affects intellectual functioning, educational attainment, economic productivity, and family stability. Intervention effort which lies between these extremes is too new to be adequately assessed. While physical environment has received much attention, priority should be given to the behavior of the interpersonal environmental agent interacting with the child and mediating between the child and physical environment. Behavioral requirements of an effective environmental agent are outlined. Longitudinal intervention research is needed and should be encouraged. (DO)

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REVIEW OF SELECTED INTERVENTION RESEARCH WITH YOUNG CHILDREN

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Review of Selected Intervention Research With Young Children

James O. Miller

National Coordination Center
The National Laboratory on Early Childhood Education

ERIC Clearinghouse on Early Childhood Education
College of Education, University of Illinois
805 W. Pennsylvania Avenue
Urbana, Illinois
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INTRODUCTION

This review of intervention research is necessarily selective. It represents what I believe to be landmark studies or examples of particular crucial problems in the field. Secondly, research until quite recently has focused primarily upon special subpopulations of children below the age of six. Early work centered primarily around the mentally retarded, more recently around the culturally disadvantaged. The need for competent research with children from average environments is sorely needed. That, perhaps, is one of the great challenges to those in Early Childhood Education, to encourage and support good research with all children in order to improve their educability and development of competency.

With this caveat expressed, let me begin this review with one of the critical early studies which has done so much to validate the efficacy of early intervention. Then I would like to briefly look at some examples of short-range interventions before reviewing a few long term studies. Finally, I would like to share some critical thoughts concerning intervention research.

REVIEW OF SELECTED INTERVENTION RESEARCH WITH YOUNG CHILDREN

It was out of the day-to-day concerns of working in an orphanage setting that one of the landmark intervention studies developed. Certainly the observations that Skeels and Dye (1939) made upon their two young placements from the orphanage to the institution for the mentally retarded have the character of serendipity associated with Fleming's petri dishes.

Skeels' (1966) description of these two young children and the account of their progress are poignant indeed. In Skeels' words, "The youngsters were pitiful little creatures. They were tearful and had runny noses and sparse, stringy, and colorless hair; they were emaciated, undersized, and lacked muscle *tone* or responsiveness. Sad and inactive, the two spent their days rocking and whining."

Psychometric examinations indicated serious mental retardation, and the youngsters were considered unplaceable with the resulting recommendation that they be placed in an institution for the mentally retarded. They were so committed at the age of fifteen and eighteen months, respectively. Six months after transfer, the children gave a completely normal picture of two young toddlers. Unmistakably, the evidence indicated their mental development was well within normal range for their ages. Subsequently they were transferred back to the orphanage and placed in adoptive homes soon after.

From this experience, a plan evolved for early placement on a "house guest" basis of an experimental group whose development was so delayed that adoptive placement seemed out of the question. Ten girls and three boys were so placed, and at the time of transfer they had an average chronological age of 19.4 months with an I.Q. mean of 64.3.

After placement of the experimental group, a control group was

established from a cottage group at the orphanage. At the time of usual adoptive placement, the twelve contrast subjects were considered normal in mental development and placeable; however, for a variety of reasons, all twelve had not been so placed. The time of the first testing, the average chronological age of the group was 16.6 months with a mean I.Q. of 86.7.

After a period of approximately two years, the experimental group showed an average gain of 28.5 I.Q. points, while the contrast group showed an average loss of 26.2 I.Q. points.

After twenty-one years, Skeels (1966) completed a follow-up study of the twenty-five subjects. The two groups were found to have maintained their divergent patterns of competency into adulthood. Educationally the experimental group completed a median of twelfth grade, while the median attainment for the contrast group was less than third grade. All members of the experimental group were self-supporting, while in the contrast group of twelve subjects, five remained wards of institutions, including one who had died during adolescence. The median income for the experimental group in 1963 was $5,220, and for the contrast group $1,200. Of the eleven married members of the experimental group, nine had children for a total of twenty-eight. These second generation children had a mean I.Q. of 104, with no indication of mental retardation or abnormality in the group. In the contrast group, two of the subjects had married. One of these marriages produced four children, all of average intelligence; the other had one child with marked mental retardation and possible brain damage.

The contrast between the attainment of these two groups is so striking that it is important to take a look at the dimensions of the early intervention where the wheels of success were put in motion for the experimental group. The orphanage environment was characterized as overcrowded, limited in resources, and understaffed, leading to depersonalization, mass handling, and an affectionless existence. On the other hand, after transfer to the institution for the mentally retarded and ward

placement, a patient or attendant emerged as the mother surrogate for the child, spending great amounts of time playing with the child, talking to him, and training him in every way. Living quarters were spacious for indoor play and activity, and the outside playground contained wheel toys and apparatus for group play. Great pride was taken by the inmates in their children, and a mildly competitive climate nurtured direct teaching of appropriate skills. As soon as the children could walk, they began to attend a nursery school or kindergarten where new play materials and additional language stimulation were provided. Additional enrichment experiences such as moving pictures, school productions, and chapel services were a regular part of the regime.

Three major points can be made concerning this experimental treatment: (1) A stimulating physical environment was provided. Toys and space to manipulate objects and apparatus both indoors and outdoors were available. An additional preschool and kindergarten experience was provided. This stimulating physical environment was continuously available to the child. (2) A stimulating interpersonal environment was provided. "Adoption" by one significant other who created an emotional and motivating relationship was an essential ingredient of the interpersonal environment. The competitive climate, where interested others contributed to the physical and cognitive stimulation of the child, created a continuous mediating interaction. (3) The mean chronological age at the time of placement was 19.4 months with a range from 7.1 to 35.9 months. Placement came at a time of maximum consolidation of intellectual functioning.

This study must stand as a landmark. Though severely criticized at the time, when the concept of fixed intelligence held sway, few today would question the importance of early intervention with these children.

Let us turn briefly to short term intervention. These studies usually are directed toward single or a very few variables. The question of import, however, is the long range effect upon what the investigators assume are important and basic variables.

An early short term intervention study specifically directed toward improving the language ability of institutionalized orphans was carried out by Dawe (1942). Her speech and language training program extended over a seven and one-half month period on weekends and was supplementary to regular nursery school and kindergarten attendance. Dawe used a matched pairs experimental design. Her experimental group prior to training had a mean I.Q. of 80.6, while her comparison group had a mean of 81.5. In addition, she matched for such variables as sex, chronological and mental age, and vocabulary, as well as school group attended. Her intervention included extensive story and poem reading to the children, picture reading and discussion, and vocabulary and concept development. On post-testing, a significant gain for the experimental group was obtained, a mean of 94.8, while the controls dropped an average of two points. Growth in vocabulary and in information test scores was also significantly greater for the experimental group.

In a six-week, short term experimental intervention, Brazziel and Terrell (1962) provided an intensive readiness program for twenty-six Negro first-grade children. The readiness program was designed to develop vocabulary, perceptual ability, increased word reasoning, and the ability to follow directions. The classroom intervention program was supplemented by parent meetings held once a week and a special educational television program which the children watched at home for thirty minutes.

At the end of the six-week intervention, Metropolitan readiness tests were administered to the experimental class as well as the three other nonexperimental classes in the same school. The nonexperimental groups had a mean attainment level of the fifteenth percentile, while the experimental children attained a mean placement at the fiftieth percentile, a substantial, and statistically significant difference.

In a short term intervention where the treatments were quite explicit, Carter (1966) worked directly on improving language ability. Carter used a matched pairs design. His thirty-two Negro culturally disadvantaged pairs were equated for chronological age, sex, Binet mental age, and total language age on the Illinois Test of Psycholinguistic Ability. An intensive forty-hour program covering ten weeks was instituted with the experimental group using the Peabody Language Development Kit, supplemented by stories and additional related activities. Two special teachers worked with small groups of eight children at a time for fifty minutes each day, four days a week, under careful supervision.

At the end of the intervention, ITPA's, Binets, Ammons, the California Test of Mental Maturity, and the Lee-Clark Reading Test were readministered. Gains in total language age on the ITPA were significantly greater for the experimental group. Gains of eleven points were posted for the experimentals, two points for the controls. Similar gains were obtained on the California Test of Mental Maturity, the Ammons, and the Binet, but no significant differences were obtained on the Lee-Clark Reading Test.

Since the treatment was focused upon the development of oral language, it is not surprising that the reading measure failed to show significant differences. Direct and specific training did get significant results on criterion measures that would be most likely to reflect change. Follow-up to the study would be valuable to see if the differential positive gains for the experimental groups generalized to other areas.

The importance of ordering tasks in appropriate sequence is underscored by a short term intervention by Sigel, Roeper, and Hooper (1966). Using nursery school subjects, they developed a training procedure for the acquisition of Piaget's conservation of quantity. Their procedure included special training on multiple relations, reversibility as a way of inducing a grasp of conservation of quantity, and multiple classification experiences. In comparison with the control subjects, significantly higher levels of performance were obtained by the experimental subjects.

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Verbalizations were also more appropriate and sophisticated. These investigators believe that failure of previous attempts to teach conservation was due to the lack of concern for the prerequisite stage related operations.

From these and other short intervention studies, the following generalizations might be proposed: (1) where limited intervention objectives in the psychomotor and cognitive areas are clearly delineated and intervention techniques are specifically designed to accomplish those objectives, significant gains can be obtained over a short intervention period; (2) such gains can be obtained over the chronological age range from neonate through early school years; (3) little evidence is available concerning the longevity of obtained effects or the effect of specific gains on more complex skills.

The Effects of Long Term Intervention. The rationale for long term intervention lies in the complexity of the problem. Multiple causation, multiple outcomes and the multiple processes involved require a more extensive involvement. Early intervention efforts were aimed at radically changing the environment in which the disadvantaged child was developing and substituting an enriched and stimulating setting for the child's growth (for example, Skeels and Dye, 1939; Kirk, 1958). Observed changes in the physical environment were striking, and while the changes in the interpersonal environment could well be as striking, illuminating the relevant characteristics was and is a profoundly difficult task. A "genuinely warm and friendly atmosphere" is a gross oversimplification of the relevant dimensions of the interpersonal environment. Relatively little descriptive space is given in the reports of these early studies to the experimental preschool or kindergarten program. In most instances, it is described in terms of a group free play program designed to develop healthy physical bodies, mature social relationships, and creativity. Such a program was consistent with the prevailing preschool and kindergarten philosophy of unfolding maturational abilities of the thirties and forties.

As the converging forces of the fifties began to be felt, a segment of the population inadequately equipped to fully participate in the afflu-

ence of the dominant society was clearly identified. Remedial measures were sought. One of the dominant themes was early childhood intervention. A means of changing the inadequate physical environment was placement of the child in a stimulating preschool or kindergarten program. Changing the interpersonal environment also became a dimension of manipulation. Such manipulations have been studied as: changing the role of the teacher from passive observer to active participant, adding more adults to the classroom to increase the availability of interpersonal environmental agents, providing ancillary personnel to bridge the gap between the stimulating and the inadequate environment and finally attempting to manipulate the inadequate interpersonal environment of the home through parental involvement in the education process.

The Perry Preschool Project (Weikart, 1967) is a preschool intervention project which has been in operation since 1962 in Ypsilanti, Michigan. The preschool program is described as a carefully sequenced program of activities planned by the teacher according to a specific developmental theory. The primary goals are for cognitive and language development. While the materials and activities frequently used are similar to traditional nursery school materials, they are used by the teacher to achieve predetermined goals. Weikart's program might best be described as developmental in itself, since over the three years of reported operation, it has evolved from a language development program using verbal bombardment techniques to a Piagetian oriented program. An interesting feature of the program has been the weekly afternoon home visit by the teacher for individual instruction. On these visits, the mother was actively encouraged to participate in the lessons.

Four groups of children with appropriate controls have been involved over the three years of operation. Significant differences were consistently obtained between the experimental and control groups after the first year of preschool participation. The average increase in Binet I.Q. scores for the experimental groups was fifteen points, while the mean increase for the control groups was three points. For the two groups which had two years of preschool prior to entering kindergarten, a

statistically significant difference of thirteen points was obtained. Only one group had completed first grade at the time of report. Gates Reading Tests and California Achievement Tests results were significantly greater for the experimental groups on all subjects.

Weikart points out three consistent findings: (1) In each experimental group a dramatic spurt in I.Q. scores was obtained after one year of intervention. (2) Control groups make significant gains on entering kindergarten, but the growth spurt is not as great as that initially obtained by the preschoolers. (3) After the second intervention year, experimental groups experience a small loss but recover during the next year.

One of the outstanding early intervention programs has been Klaus and Gray's (1967) Early Training Project in Tennessee. It was a particularly well designed field research which embodied follow-up study as the children progressed through the primary grades.

A population of sixty-two children was identified in a small Tennessee town whose families met the housing, parent level of education, and occupational criteria established as defining the culturally disadvantaged. The children were randomly assigned to one of three groups: a three-year treatment intervention, a two-year treatment intervention, or a local control group. A fourth comparison group was established in a similar town some distance away as a distal control group.

Intervention techniques and content were developed based on research of differential child-rearing patterns and intellectual and attitudinal differences related to social class, and extensive observation in disadvantaged homes. The program consisted of two parts: (1) a ten-week preschool classroom experience successively for two or three summers, depending upon the treatment group; and (2) a home-based instructional program, implemented by a staff home visitor between the summer classroom experiences for the children. The classroom program centered around two major classes of variables — attitudes toward achievement and aptitudes for achievement. Specific experiences were designed to foster growth in these areas. The ratio of adults to children

in the classroom was approximately one to four or five, which maximized the amount of adult-to-child interaction, provided effective role models, and encouraged individualization of instruction. (See Gray, and others, 1966, for a more extensive description of the procedures used in the classroom.)

A variety of evaluative instruments was used over the experimental period and the follow-up. These included the Binet, PPVT, WISC, ITPA, Metropolitan Readiness and Achievement Tests, and the Stanford Achievement Tests. The significant gains obtained by the experimental groups when compared with the control groups had been maintained through June of 1966. As with similar studies, initial gains were dramatic, the gain was held until entry in school, and then a slight decay began to appear. The magnitude of the differences between groups decreased when the comparison group entered school, but subsequent to their initial but lesser spurt, the decay began to be evidenced in these groups also. Results on the ITPA, WISC, and PPVT are similar to those obtained on the Binet. On the Gates and the Metropolitan Readiness Tests, significant differences in favor of the experimental groups were obtained in ten of eleven comparisons. Mean score differences on the Metropolitan Achievement Tests were in favor of the experimental groups. Over the two years there were significant differences in word knowledge, word discrimination (first year only), and reading. No significant differences were obtained between experimentals and controls in arithmetic or spelling. On the Stanford Achievement Tests, word reading and paragraph meaning show significant differences in favor of the experimental groups but equal achievement in other subject matter areas tapped by this test.

Particularly impressive is the evidence Klaus and Gray have marshaled for diffusion effects within the community as well as within families. In a number of comparisons between the proximal and distal control groups, significant psychometric differences were found which suggest a community diffusion effect. Anecdotal evidence and studies of the intercommunication patterns between the parents of the three groups

suggest that a somewhat complicated communication net existed among the parents of the community groups. Anecdotal evidence bears witness to the attempts by the in-community control group parents to augment the experiences of their children modeled on the project's intervention. Evidence of within-family diffusion to younger siblings of the experimental children is reflected in Binet comparisons with the younger siblings of the control groups. Here a thirteen point I.Q. difference was found in favor of the experimental younger siblings. Further studies of diffusion phenomena are being carried on currently (Miller, 1967).

Klaus and Gray are refreshingly cautious concerning their results at a time of great enthusiasm over the effects of intervention. They point out that their contact time with the families represents a very small proportion of the time a child spends in adverse environmental conditions before he gets to school. (By my calculations, the maximum amount of contact the investigators could have had with any one child was six hundred hours. This represents less than 2 percent of the average waking hours that a child has from birth to six years of age.) That a minimal contact such as represented here can have the effect that it apparently has had is indeed optimistic. The question is not *whether* intervention, but *how* can we be more effective. Klaus and Gray's work suggests some potentially fruitful directions.

Over the past several years, investigators at the University of Illinois have been studying an approach to preschool education which is quite alien in content and technique to traditional concepts. Formal subject matter is taught in a highly structured, direct verbal instruction program. Since language is the area of greatest weakness among disavantaged children, language remediation and development form the core of these programs. In addition to language, arithmetic, reading, and social studies or science are usually emphasized with some additional time being devoted to activities which are supportive of the direct instruction content. Story reading, music, and directed play with perceptual type toys are available for free choice. For the formal direct instruction, the large group is broken into three smaller groups, each led by a teacher

in a small room. The facilities seem to have some control over the amount of direct instruction administered.

Because language plays a central role in the instructional program, heavy reliance is placed upon the Illinois Test of Psycholinguistic Ability as a criterion measure as well as a diagnostic instrument. Other instruments are used to evaluate progress as well.

Karnes and others (1966) made a comparative study of the effectiveness of a highly structured direct instructional program and a traditional program for culturally disadvantaged children. Their sample met the usual socioeconomic and home criteria for disadvantaged families. Sixty children were selected for placement in the program and assigned to experimental or comparison classes from three stratified intellectual levels on a random basis. Adjustments were made in the racial and sexual composition of the classes. Two experimental groups and two comparison groups of fifteen children each were thus constituted.

This program concentrated on language development, mathematics, and social studies or science in the direct formal instruction. Each teacher kept anecdotal records on each child in her group in order to be able to individualize her instruction. Subject matter was presented most frequently in game format, with a heavy emphasis upon manipulative and multisensory materials. The investigators held that reduced teacher-pupil ratio promoted immediate feedback and differentiation of instruction insured success. These factors, they felt, were highly relevant to motivation.

The experimental subjects obtained a fourteen point I.Q. gain on the Binet compared to an eight point gain for the comparison groups, a significant difference. There were no significant differences in gain on the ITPA. Both groups achieved mean gains of fourteen months during the seven-month program. The mean gain on the PPVT was in favor of the comparison groups, although it did not reach statistical significance.

In a demonstration project, Bereiter (1967) explored the limits of attainment which disadvantaged preschool children might reach, given

a structured direct instruction program. It was assumed that disadvantaged children differed from others in what they had not learned previously. Therefore, by more efficient engineering of the teaching process in critical areas of knowledge, rapid progress could be made to catch up with more advantaged peers.

A sample of fifteen four-year-old children was selected on the basis of having older siblings with educational difficulties, homes where cultural deprivation was assumed to be the primary contributing factor, and the ability to produce some intelligible verbal response on the ITPA. No comparison group was used to evaluate the results of the two-year program. Instead, evaluation of the program was based upon its measurable effects on achievement and language-test performance where the test norms provided the base line. The ITPA, the Stanford Binet, and the Wide-Range Achievement Test were the measures employed for the evaluation.

An extensive description of the methods and procedures used in this program and subsequent ones has been published by Bereiter and Engelmann (1966). Language, arithmetic, and reading formed the core of the formal curriculum during the first year. During the second year, formal language instruction was discontinued and replaced by science and verbal reasoning.

Over the two-year intervention period, enough language learning had taken place as measured by the ITPA to move the group from a year or more below average up to an average level of performance for their chronological age. Similar findings on Binet MA were obtained. On the Wide Range Achievement Test at the end of the second year (the kindergarten year), the mean attainment expressed in grade equivalent scores in reading was 1.5, in arithmetic, 2.6, and in spelling, 1.7.

Bereiter believes the issue with preschool education for the disadvantaged is one of studying the task and what it requires versus studying the child and how he functions. He does not believe he is putting an armchair analysis of content against empirical study of children's learning but, rather, ordering events which the adult follows in designing pro-

grams for young children. His approach would seem to imply following these steps: (1) identifying, on the basis of empirical evidence, the deficits of the subgroup in question; (2) identification of teaching objectives based upon those deficits; (3) analysis of content and operations in order to teach the material directly; (4) empirical field trial and testing; and (5) feedback to step 3.

At least two long-term intervention studies have been based on a different approach from those which have been reported so far. Blatt and Garfunkel (1965) and Nimnicht (1966) have taken an "emergent" developmental stance and designed their studies on this basis. In each, the objective was to provide an optimal nursery school environment. Each also used the "talking typewriter" or responsive environment as a central instructional device.

Blatt and Garfunkel described their program as "experimental, emergent, child-centered, and adhering to the basic principles of any sound preschool program — but over and above this, focused on the intensified development of preacademic skills." Responsive environment cubicles were available for the children to use if they so desired. Each cubicle contained an electric typewriter, a slide projector, a microphone and amplifier, and a "neutral" booth attendant. The purpose of the booth attendant was to give feedback as the child used the machine. A responsive environment is defined as one which is attuned to the child's exploratory activities, informs the child immediately about the consequences of his own actions, permits him to make extensive use of his capacity for discovering relations, and is so arranged that the child is likely to make a series of interconnected discoveries about some aspect of the physical, cultural, and social world. Thus, this program relied upon the emerging ability and *innate* curiosity drive to direct the course of the child's development in the preschool program.

A number of evaluative instruments were used in assessing the effects of the program; however, the research hypothesis that the two-year intervention would enhance the demonstrated educability of the experimental children when compared to the control group was rejected. The inves-

tigators concluded that the failure of the intervention as an effective force was in part a failure of the instruments to differentiate and an inability to maintain a true experimental design.

Another study now in progress (Nimnicht, and others, 1966), a program similar to that of Blatt and Garfunkel, reports significant increases on the PPVT after a year of intervention with Spanish-American children but no significant differences on the Binet. While these two bits of research evidence are hardly enough to make a case, it is legitimate to question the validity of the developmental concept of emergence as a viable position on which to base intervention techniques and procedures.

One of the most active groups reporting in the literature from overseas is located in Israel. In the developing kibbutzim, with their special child care arrangement, a natural intervention laboratory is available for extensive study of the effects of early work with children. In 1964, Sarah Smilansky made a report on an experimental program for culturally deprived oriental Jewish children. The program was directed toward preparation for school requirements and development of specific deficiencies. Four experimental and four control kindergarten classes were studied with a normal class size of approximately thirty-five children. Regular teachers were used, but in the experimental classrooms additional assistance and materials were provided by specialists. Carefully detailed objectives in keeping with the program goal were the guide to intervention procedures for the experimental groups. The control groups had regular kindergarten instruction.

Following the intervention year, the experimental groups obtained an average superiority of six points on the Stanford Binet and ten points on the WISC contrasted with the regular kindergarten attenders. While all of the experimental group children showed some gains on the criterion measures, the children who scored lower on the initial tests obtained the greatest gain over the intervention year (Smilansky, 1964).

A later study by Smilansky (1966) on the relative contribution of different intervention procedures to learning ability and achievement

progress revealed the following to be significant classroom operations: (1) active guidance by the teacher in learning the underlying rules for task success in contrast with learning through general instructions; (2) directed performance of specific task with the aid of a clear frame of reference; and (3) post performance verbalization. A fourth operation, setting of specific achievement demands adapted to the ability of the child, was not found to influence improvement in the child's achievement.

Smilansky's contribution to answering the question of "how?" is as important as her contribution to the question of "what?" Specification of the environmental agent as an active participant in the learning process is of major importance to understanding intervention processes.

Critique

In all candor, a review of intervention research results leaves us with a spirit of cautious optimism. Enthusiasm runs high to do something — almost anything — for young disadvantaged children. However, the mass crash programs have failed to produce evidence of their effectiveness. Part of the difficulty is the service priority and lack of adequate planning time for sound evaluation. A more serious problem is the traditional emergent philosophy which undergirds most programs. There is little or no evidence to support such a theoretical stance, nor is there evidence to support practices based on this theory. It may take as long to get over the cure as it did to recognize the disorder.

The available intervention research findings indicate that short term gains can be made on specific behaviors where the intervention is directly related to such behaviors. At the simplest level, gains have been obtained with infant psychomotor abilities as well as the more complex cognitive abilities of the preschool and school-age child. The effects

of short-term change in limited domains upon complex behaviors have not yet been established.

Under conditions of massive environmental change, striking and massive improvement can be obtained in abilities associated with adult social competence. Radical environmental manipulation has been shown to affect intellectual functioning, educational attainment, economic productivity, and family stability.

Intervention effort which lies somewhere between these extremes is too new to have the long-term effects adequately assessed. With varying degrees of confidence, research evidence suggests that early intervention at a preschool level has marked short-term effect upon children. Sizeable initial changes in intellectual functioning have been recorded. These gains are superior to those obtained by comparison samples. Comparison groups usually obtain significant gains upon entering school, but they are not of equal magnitude to those obtained by the intervention groups. There is some evidence showing generalized effects of early intervention to later school achievement. Where such results are observed, parental involvement is usually a part of the intervention program.

Implicit in much of the research which has been reviewed are the beginning steps to identification of the dimensions of the physical and interpersonal environments in isolation and interaction which are necessary and sufficient for development of competence. While the stimulating physical environment could be described at length, I would order the priorities in favor of dealing with the stimulating interpersonal environment first, since this has had so little attention. The most important aspect of the stimulating interpersonal environment is the *behavior* of the interpersonal environmental agent who interacts with the child and mediates between the child and the physical environment. The following outlines the minimum behavioral requirements for an effective environmental agent: (1) An effective environmental agent provides a rich verbal climate, describing events and their relationships and encouraging a high level of verbal productivity and interaction; (2) the effective agent provides direct mediation between the physical environ-

ment and the child by (a) ordering the physical and spatial environment by monitoring and directing attention to the relevant dimensions of the stimulus-informational input; (b) ordering the temporal environment by monitoring and directing attention to the sequence of environmental events; (c) ordering tasks sequentially in magnitudes of just manageable difficulty to insure successful accomplishment; and (d) providing an appropriate response model which the child can emulate and imitate in a variety of environmental contexts. (3) The effective environmental agent provides motivational support by (a) creating a reality oriented emotional attachment which matures from dependency to active, involved encouragement of independence; and (b) using a range of reinforcing techniques which are appropriate to the task. Reinforcement should move from the concrete to the abstract and from the extrinsic to the intrinsic.

These appear to be a set of minimum behaviors to provide a stimulating, interpersonal environment. Such a model may move us somewhat beyond the description of "warm, affectionate adults" and lead to productive hypotheses and development.

The state of intervention research has not yet reached the stage where tests of the most efficient intervention treatments are appropriate. Yet there is a great hue and cry for testing Montessori approaches versus Bereiter approaches. Testing of such questions seems not only premature but wasteful when we have not yet answered the vital question of what variables are related to productive change.

Since intervention research occurs in a field setting, it is difficult, if not impossible, to maintain optimal management of the variables which can introduce a systematic error. Intervention research has been described as dirty research, not without just cause. There is hardly a point in the research strategy which is not vulnerable to the introduction of unforeseen, unwanted, and uncontrollable error. The problems have been well-documented by active investigators in the field. (See Blatt and Garfunkel, 1965; Klaus and Gray, 1967; Hodges, McCandless, and Spicker, 1967.)

The practical and earthy problems of intervention research are seldom discussed in writing. Yet they exist and may contribute more than we would like to admit to the relative scarcity of longitudinal intervention effort. Field research is costly, not only in money, but in time and staff commitment. It requires a tenacity which internal and external pressures cannot quickly erode. The lure of the quick, clean, and publishable can measure the mettle of the man. The need for intervention of a longitudinal nature, however, is apparent. Encouragement should be given to young, creative talent to pursue this line of endeavor.

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